Artificial Coalification of the Mixtures of Cellulose and Lignin

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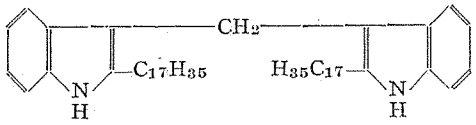
c) Reaction with formaline.

Bis-(2-n-heptadecyl-indolyl)-methane (III) was obtained by the reaction between (II) and formaline.



Yield 31%; m.p. 103°C.; mol. wt., 730 (calcd. 724); N% 3.81, (calcd. 3.87).

Further we tried to obtain a Mannich base from (II) under various conditions, but against expectation the product obtained was only (III).

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22. Artificial Coalification of the Mixtures of Cellulose and Lignin

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According to the Bergius' "Artificial Coalification Method", the mixtures of cellulose and lignin (in various ratios) were artificially coalified in water, *N*/10-NaOHor *N*/10-oxalic acid medium at 300°C for 6 hrs. Yields of artificial coals were measured and proximate and rational analyses were carried out.

Artificial coals, produced in water medium, scarcely showed caking power and comparatively lignin rich ones sintered strongly; on the other hand, cellulose containing (more than 40%) coals, produced in alkaline or acidic mediums, has a strong caking power.

The co-existence of cellulose and lignin results the increase in yield of produots and the increase in volatile matter or bitumen of products (in another words, bituminisation of lignin is promoted). It has been recognized, when cellulose and lignin were artificially coalified individually, very active intermediate products were formed and these polymerized easily. There may be some chemical combinations between these two intermediates, namely, the artificial coals from mixture of cellulose and lignin are not the mixtures of cellulose coal and lignin coal but partly consist of combined substances.

There are no doubts that natural coals were formed from woods through huminificating and dynamochemical actions. On the other hand up-to-date theories for coal formation scarcely have payed attentions to the relation between coal characters and chemical compositions of the starting materials for the dynamochemical stage (for example, the ratio of cellulose to lignin content of decayed wood or humus) Considering our previous works and this experimental result, it seems adequate to conclude, the complicated characters of natural coals depend considerably upon the chemical compositions of the materials, and cellulose has a great effect on the caking property of bituminous coals.